

NORBIT NORdredge - *Dredging Monitoring Made Easy*

Standalone use case

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Summary

Since the beginning of water transportation, the maintenance and monitoring of waterways was major issue when concerning the safety of voyages. The dredging development since its beginning was directly allied to development of the monitoring capabilities of the water depths during the dredging operations. Underwater acoustic play essential role as remote sensing, replacing mechanical measurement methods. Recently, multibeam gave a real boost to the underwater dredging monitoring due to wide coverage and high efficiency. The intrinsic problem with multibeam dredging monitoring has been the complexity of system setup and sonar operation, which often required extensive experience in hydrographic surveying. It became a problem for smaller dredging setups where the operation is carried by single operator or a small number of personnel. They rely on sub-contracting of the hydrographic surveys to third party companies which reduces their revenue margins and sometimes makes impossible to achieve financially sound operation.

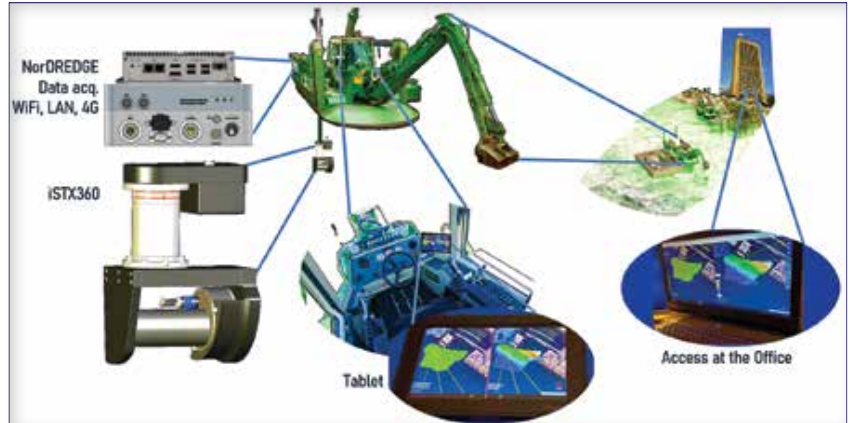


Fig. 1 NORdredge operated via web browser on rugged tablet or PC

In 2018 NORBIT introduced a 3D sonar system, called STX360, for dredging applications allowing to observe the 3D bathymetry and imagery in real time during the dredging operation facilitated by the electronic scanning capabilities build into the transmitting antenna of the system. The STX360 scanning sonar has been used in bathymetry surveys and in dredging surveys but also in several adjacent applications like rock dumping and cable laying set-ups. In all cases the system offers excellent performance and efficient monitoring of the operation in real time. With the tightly integrated GNSS/INS system and the 360 deg titanium rotation system the iSTX360 system has become a dredge survey ready suite for any installations. In 2020 NORBIT has developed a software utility to facilitate the data collection and visualization for iSTX360 used for dredging monitoring and was given a name NORdredge. NORdredge is based on the NORBIT Open Hydrography Platform and continues the software solution simplifying the data collection initiated with the bathymetry data acquisition software - DCT.



NORdredge is a web-oriented utility which directly interfaces to NORBIT iSTX360 multibeam sonar system and is designed to monitor the dredging operation in real time with simple use interface and minimal installation efforts. It has been designed to facilitate three kinds of use case serving different users, needs and installations. These are:

- Standalone operation supporting small installations and end users,
- Used as a middleware as integrated part of in third-party (OEM) solution,
- As monitoring tool adding an extra redundancy to large productions. That is to increase safety and efficiency of the operation.

This paper details out the use first cases of NORdredge as a standalone utility and briefly discusses other use cases which will be covered in future publications.

NORdredge and iSTX360 in a standalone operation

The first and main use of NORdredge is a standalone operation for dredging or rock dumping. The users connect to the data acquisition PC (via Wi-Fi, LAN or 4G network) using nothing else but the web browser. It is completely web based and any device with the web browser can be used to access and operate NORdredge.

The dredge is equipped with the iSTX360 which is the integrated 3D sonar

with INS system and robust titanium rotating mechanism. All in one consolidated lightweight device attaches to the pole or frame of the dredge or barge. The single pair of cables connect to the top side which connects the GNSS antennas for navigation as well as provides the power to the rest of the system. The industrial computer hosts the NORBIT software including NORdredge server and is responsible for all data acquisition.

The clients can connect in various ways to the NORdredge computer either directly, via mouse and keyboard, but more importantly with the remote clients utilizing the ruggedized tablets connected wirelessly.

The wireless connection helps tremendously in limiting the network of cables and avoids expensive failures due to puncturing or destroying the cables. The wireless communication is facilitated by standard Wi-Fi or even mobile communication standards such as 3G/4G/5G and Internet networking. The latter being useful when client is in remote location where standard Wi-Fi does not reach. The office personnel can take great advantage of that feature where the particular dredging station can be accessed from any location in the world.

All the user's terminals, the operator and all remote users, share the same underlying data in the real time. Each user can take advantage of several displays offered by NORdredge such as real time bathymetry, differential grid, backscatter imagery and couple of QC tools such as standard deviation of the bathymetry soundings and their density.

The users operate on the same underlying data and can use NORdredge to effectively manage the dredging monitoring by adjusting the coverage, setting up the run lines or planning the next step during the mission. The differential grid on the left-hand side provides immediate information on the area to be dredged by comparing the design template to the real time depth and showing in simple colors what and where to dredge.

With a single button click the user instructs the system to collect the data. The data is securely stored on the survey computer in a popular s7k file. This file contains all bathymetry data and navigation data and can be used for future post-processing if needed. At the same time the system collects the raw GNSS/INS observables which can be used to post-process the navigation with PPK etc. which can be used for the final delivery of the bathymetric maps for PRE and POS surveys. That offers a possibility to avoid expensive pre- and post- surveys and use the data collected during the dredging as a final deliverable. At any time during the operation the operator have access to QC displays. The real time display shows the mentioned real time depth and also standard deviation, sounding density and backscatter, all of which are updated at the same time and

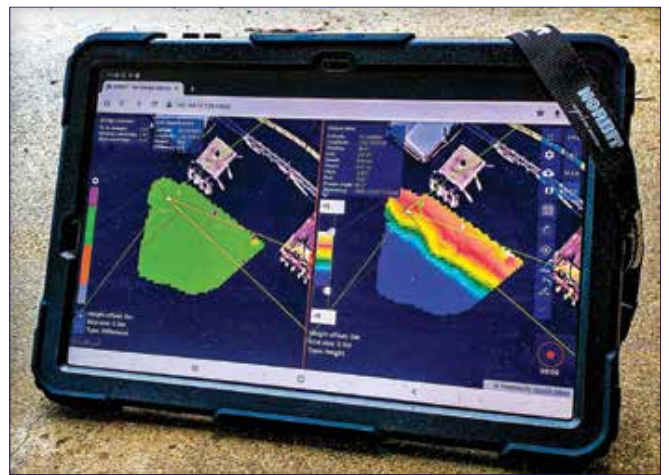




Fig. 2 NORdredge split screen display with real time and differential depth


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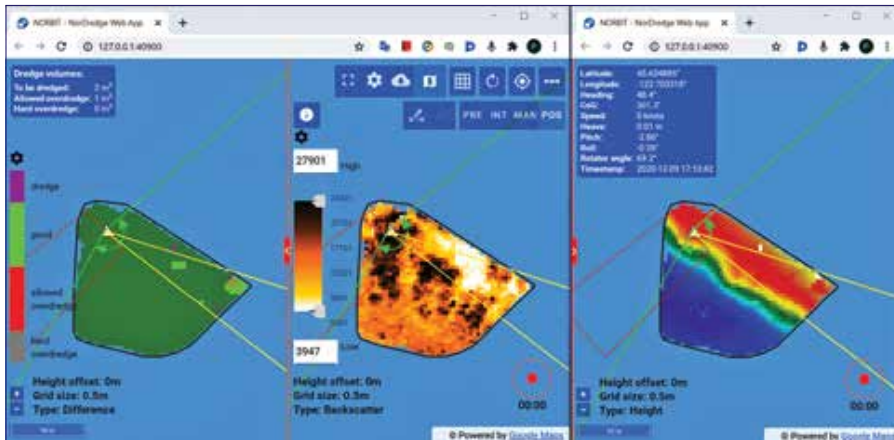


Fig. 3 NORdredge differential, backscatter and depth displays

3. NORdredge in action

Some smaller operations tend to be very dynamic and the dredge moves from one area to another quickly. There is no time for extensive logistics or extra survey vessel to conduct the pre/post survey and the readings of the bathymetry needs to be done on spot to allow the operator to take an immediate decision to move the dredge to next location. NORBIT iSTX360 and NORdredge is designed for this kind of operations. The instantaneous measurement of the bathymetry and clear displays on a single screen is sufficient for operator to conclude the survey.

As an example of such dynamic survey a short dredging operation was conducted in

December 2020 where few buckets drop were needed to be performed in certain areas and move very quickly to another area along the shore of Columbia River in Portland, Oregon.

With this type of operation NORdredge offers great advantage to the operator with the capability of quick measurement the bathymetry of dredged area and swiftly conclude the mission without any wait time for survey vessel to perform additional surveys. The raw data is securely stored on the industrial PC and can be further post-processed for the final delivery without the need to perform the additional post survey.

4. Other uses of NORdredge

We will just mention two additional use cases in limited details due to the size of this article but more information is available on NORBIT web site and will be published in the future.

The second use case for NORdredge is unique opportunity for OEM partnership for companies who provide their own offerings in the dredging industry. It allows the third-party solution provider to seamlessly integrate the bathymetry layer offered by NORBIT into their product without undertaking on the whole development of data acquisition and bathymetry maps generation. All that is already managed by the Open Hydrography Platform (OHP) architecture on which NORdredge is based on. That includes the well-known GIS platforms GeoServer, Postgres database and PostGIS which are used by NORBIT OHP and provides seamless access to the data as well as tiles of generated maps.

Last use case of NORdredge is a monitoring of the large dredging operations by providing situation awareness, which can operate concurrently with large production dredging software. That adds the redundancy to the current main framework as the map generation is completely detached from the mainframe map generation and does not infringe any risk of disturbing the production logistics. In this case the NORdredge function is simply monitoring function where redundant displays are separated from the main production and can be freely used by all interested parties. That includes the vessel personnel but also the personnel in the office, which can access the same operational picture via Internet. This immediate situation awareness improves the logistics and planning as well as efficiency as all interested parties have access to the same information without disturbing the main production team.

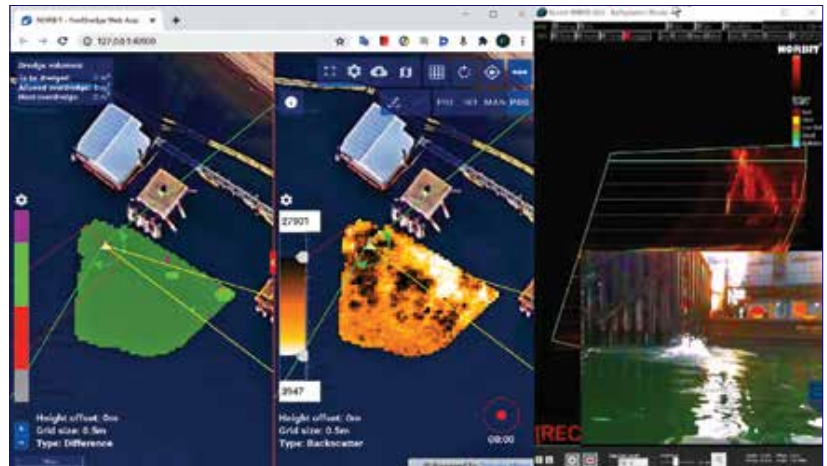


Fig. 4 NORdredge in real time dredging monitoring

5. Conclusions

NORBIT iSTX360 solution along with NORdredge utility is simple and useful tool for various dredging operations. The web browser interface allows to conduct and monitor the dredging mission in efficient way. It is suitable for small dredges and single person operations as well as the larger operations working as middleware or as monitoring tool supporting the main production. The iSTX360 and NORdredge through web-based displays allows to access the survey result and monitor the progress from any terminal in the network either local or remote via Internet. See ad on pg. 10, www.Norbit.com